which is at least 20% less in the thermally and mechanically stressed areas than it is in horizontally adjacent areas.

## REMARKS

With and extension of time of two months, the present paper is timely submitted on or before November 6, 2001. By the present amendments, claims 8 and 13 are cancelled without prejudice or disclaimer of subject matter therein and claims 1, 3, 5, and 9-12 are amended. Accordingly, claims 1-7, 9-12, 14, and 15 are in the Application. Reconsideration of the Application in view of the foregoing amendments and following remarks is respectfully requested.

*The Claim Amendments*

A marked-up version of the amended claims is attached as Exhibit A

Claim 1 was amended to recite that the side wall defines a meniscus area and that the die body has a cooling surface side and a pouring side. Claim 1 was also amended to incorporate the limitations of claim 8, which previously depended from claim1, and to address objections raised in the Office Action. Applicants respectfully submit that support for the amendments can be found in the specification at, for example, page 2, line 20, page 5, lines 31-32, page 4, lines 14-18, in the Figures, and in the claims as filed.

Claims 3 and 5 were amended as required by the Office Action. Applicants respectfully submit that support for the amendments can be found in the claims as filed.

Claim 9 was amended to make it consistent with claim 1, from which it depends. Applicants respectfully submit that support for the amendments can be found in the support for the amendments to claim 1.

Claim 10 was amended to recite that the pouring side of the mald is aeparated from the bath. Applicants respectfully submit that support for the amendments can be found in the specification at, for example, page 2, line 20, and page 5, line 30.

Claim 12 was amended to incorporate the limitation of 13 a[illegible]o make it consistent with claim 1 from which it depends. Applicants respectfully submit that support for the amendments can be found in support for the amendments to claim1 and in the claims as filed.

Applicants respectfully submit that the forgoing amendments introduce no new matter into the Application.

*Claims Objected To*

Claims 1, 3, 5, and 12 were objected to as allegedly containing grammatical errors. Applicants respectfully submit that the present amendments render moot and overcome these objections.

*Claim Rejections Under 35 U.S.C. § 112, Paragraph Second*

Claim 1 was rejected under 35 U.S.C. § 112, second paragraph because "critically stressed areas" allegedly lacked antecedent basis. Applicants respectfully submit that, when read in light of the specification, the stressed areas in which the cooling zone is located would be clear to the skilled artisan. Accordingly, Applicants respectfully submit that the rejection should be withdrawn.

Claim 6 and 7 were rejected under 35 U.S.C. § 112, second paragraph because the "meniscus" and "broad-side wall" allegedly lacked antecedent basis. Applicants respectfully submit that the present amendments overcome any basis for the rejection that may have existed and that the rejection should therefore be withdrawn.

Claims 8 and 9 were rejected under 35 U.S.C. § 112, second paragraph because the terms "more stressed area" and "bath surface" allegedly lacked antecedent basis. Applicants respectfully submit that the present amendments overcome any basis for the rejection that may have existed and that the rejection should therefore be withdrawn.

Claim 10 was rejected under 35 U.S.C. § 112, second paragraph because the terms "bath" and "broad side walls" allegedly lacked antecedent basis. Applicants respectfully submit that the present amendments overcome any basis for the rejection that may have existed and that the rejection should therefore be withdrawn.

Claim 11 and 13 were rejected because the terms "wall" (claim 11), spacing (claim 13), and "bath surface" (claims 11 and 13) allegedly lacked antecedent basis. Applicants respectfully submit

point-out that inherent components of elements (e.g. "bath surface") have antecedent basis in the recitation of the components themselves ("bath"). Failure to provide express antecedent basis does not render a claim indefinite if the scope of the claim would be reasonably ascertainable by the skilled artisan. *See* M.P.E.P. § 2173.05(e). Moreover, Applicants respectfully submit that the present amendments have removed any basis for the rejection that may have existed. Accordingly, Applicants respectfully submit that the rejection should be withdrawn.

*Claim Rejections Under 35 U.S.C. § 102*

Claims 1, 6, 7, and 10-13 were rejected under 35 U.S.C. § 102(e) as allegedly anticipated by Grove et al., United States Patent 5,927,378. For the reasons discussed below, Applicants respectfully traverse.

Grove et al. teach a mold liner for continuous casting of metals that has a selective cooling structure for selectively cooling the mold liner assembly such that cooling is directed in varying intensities to different potions of the inner surface of the mold liner assembly. Grove et al., col. 2, lines 10-14. Grove et al. do not teach any quantitative limitations on the difference in heat flow rate between thermally and mechanically stressed portions and other portions of their mold liner. Applicants claims recite quantitative limitations on the difference in rate of heat flow between different portions of their mold. Because Grove et al. do not teach Applicants' invention in as complete detail as is contained in Applicants' claims, Applicants respectfully submit that the rejection should be withdrawn.

Claim 1 was rejected al allegedly anticipated by Villanueva et al. For the reasons discussed below, Applicants respectfully traverse.

Villanueava et al. teach a funnel-type ingot mold having a cooling optimized area (col. 2, lines 4-5) made-up of, *e.g.*, triangular shaped depressions. Villanueva et al. generally teach that the geometry of their depressions is uniform over the cooling optimized area. *See, e.g.*, Villanueva et al., col. 2, lines 2-29. Villanueva et al. do not teach that the dimensions (e.g., depth) or geometry of their depressions should be varied to achieve specific quantitative differences in heat flow rate between specific cooling zones or between different portions of their cooling optimized area, as is required by Applicants' claims.

Villanueva et al. do not teach the specific quantitative differential in heat transfer between different parts (areas) of their casting die required by Applicants' claims. Because Villanueva et al. do not teach Applicants invention in as complete detail as is contained in Applicants' claims, Applicants respectfully submit that the rejection should be withdrawn.

Claims 1-5 were rejected under 35 U.S.C. § 102(a) as allegedly anticipated by Stagge et al., WO 97/43063. For the reasons set-out below, Applicants respectfully traverse.

Stagge et al. teach a funnel-type mold comprised of, among other things, opposing broad-side walls, made of e.g. copper, having coolant channels that provide increased heat transfer from the casting (pouring) side to the cooling water (cooling surface side). Stagge et al. do not teach that the heat flow rate in a cooling zone in a mechanically or thermally stressed area of their die should be 5% to 40% greater than that in other areas of the adjacent surface of the mold, as is required by Applicants claims.

Applicants were the first to observe that the service life of plate-type casting dies having a funnel expansion in the upper area of the plate could be extended (e.g. by reducing the incidence of surface cracks) by providing for 5% to 40% higher rate of heat flow (cooling rate) in critically stressed areas of the mold compared to adjacent areas of the mold. Applicants respectfully submit that Staggee et al. do not teach this limitation recited in Applicants' claim and that the rejection should therefore be withdrawn.

*Claim Rejections Under 35 U.S.C. § 103*

Claims 6 and 7 were rejected as allegedly unpatentable over either of Villanueva et al. or Stagge et al. in view of Klein et al., United States Patent 5,095,970. For the reasons set-out below, Applicants respectfully traverse.

Villanueva et al. teach an ingot mold of multiple conical design having multiple depressions (conical, trapezoidal) on an outer cooling surface that facilitate cooling of the mold. Villanueva et al. are silent on the distance these depressions extend from the meniscus – if any – of their mold. Stagge et al. teach a multiply-tapered liquid-cooled casting mold comprising broad-side walls formed of copper plates equipped with slot-like cooling channels running parallel to the casting direction. Assuming *arguendo* that the optional "flare" at the input end of the mold (*see* Villanueva et al. page 5, line 11) *were* to define a miniscus, Stagge et all are silent concerning the disposition of their channels relative to the "flare".

Klein et al. teach a cooling device for a continuous casting mold arranged on the wide side of the mold and extending 55% to 75% of the height of the wide side *measured from the bottom of the mold*. Klein et al., col. 1, lines 31-34 (emphasis supplied). The cooling device of Klein et al. never reaches an area of the mold that the skilled artisan would associate with a meniscus area, as that therm is used in Applicants' claims. Assuming *arguendo* that there were proper suggestion or motivation for combining the references, no combination of Villanueva et al., Stagge et al., and Klein et al. teaches or suggests all of the limitations of Applicants' claims 6 and 7. Accordingly, Applicants respectfully submit that the rejection should be withdrawn.

Claims 8 and 9 were rejected under 35 U.S.C. § 103(a) as allegedly unpatentable over any one of Grove et al., Villanueva et al., or Stagge et al. in view of Hargassner, United States Patent 5,117,895. For the reasons set-out below, Applicants respectfully traverse.

Grove et al. teach a mold liner for continuous casting of metals having a selective cooling structure for selectively cooling the mold liner assembly such that cooling is directed in varying intensities to different potions of the inner surface of the mold liner assembly. Grove et al., col. 2, lines 10-14. Grove et al. do not teach any quantitative limitations on the heat flow rate within any portion of their liner, let alone teach *differences* in heat flow rate between thermally and mechanically stressed portions and other portions of their liner.

Villanueva et al. teach an ingot mold of multiple conical design having multiple depressions (conical, trapezoidal) on an outer cooling surface that facilitate cooling of the mold. Villanueva et al. are silent on the heat flow rate in the area of these depressions. Stagge et al. teach a multiply-tapered liquid-cooled casting ,old comprising broad-side walls formed of copper plates equipped with slot-like cooling channels running parallel to the casting direction. Assuming *arguendo* that the optional "flare" at the input end of the mold of Stagge et al. (*see* page 5, line 11) *were* to define a meniscus, Stagge et al. are silent concerning both the heat flow rate in this area and the difference in heat flow rate between this area of the mold and other areas of the mold.

Hargassner et al. teach a plate mold for continuous casting comprising plates provided with cooling channels of a particular size (e.g. 13 mm), which plates can exhibit a heat transmission coefficient (α) of between 20 and 70 $kW \cdot m^{-2} \cdot K^{-1}$; depending on the flow rate (Q) of

the coolant in the cooling channels. Hargassner et al. teach that the absolute value of the heat transmission coefficient ($\alpha$) can be varied by changing the coolant flow rate within a particular range. Hargassner et al. do not teach or suggest that $\alpha$ in one area of their mold should differ by a specific amount (10% to 20%) from $\alpha$ in another adjacent portion of their mold, as is required by Applicants' claims. Indeed, the skilled artisan inspecting Figure 3 of Hargassner et al. would conclude that, in those areas provided with cooling channels, the channels – and associated "alphas" – of the plate mold of Hargassner et al. are everywhere *equal.*

Assuming *arguendo* that the skilled artisan *might* be motivated to combine the teachings of Hargassner et al. concerning the relationship between coolant channel dimension, heat transfer rate, and coolant flow rate to other the cooling of other casting molds; no combination of any or all of Grove et al., Villanueva et al., Stagge et al., and Hargassner et al. teaches or suggests a casting die meeting all of the limitations of Applicants' claims. Accordingly, Applicants respectfully submit that the rejection should be withdrawn.

Claims 12-15 were rejected under 35 U.S.C. § 103(a) as allegedly unpatentable over either of Villanueva et al. or Stagge et al. in view of Nakashima et al., United States Patent 5,207,266. For the reasons set-out below, Applicants respectfully traverse.

Villanueva et al. teach an ingot mold of multiple conical design having regularly spaced multiple depressions (conical, trapezoidal) on an outer cooling surface which depressions facilitate cooling of the mold (*see* Figures 1 & 2). Villanueva et al. are silent on the distance these depressions extend from the meniscus – if any – of their mold, and are silent on dimesions of the depressions in different areas of their mold . Stagge et al. teach a multiply-tapered liquid-cooled casting mold comprising broad-side walls formed of copper plates equipped with slot-like cooling channels running parallel to the casting direction. Assuming *arguendo* that the optional "flare" at the input end of the mold (*see* page 5, line 11) *were* to define a miniscus, Stagge et al. are silent concerning the spacing and disposition of their channels relative to the "flare".

Nakashima et al. teach a water-cooled casting mold made of copper and fastened together with bolts in bolt fastening regions. Applicants assume *arguendo* that the bolt fastening regions are regions of higher thermal and mechanical stress. The bolt fastening regions have cooling channels "in which the widths of the main channels ... are *wider* than those in other regions". Nakashima et al., col. 1, lines 51-52 (emphasis supplied). Also, the skilled artisan inspecting Figure 14 would note that inclusion of the "increased channels" in the bolt fastening region

causes the channel spacing in the bolt fastening regions to be narrower than it would have otherwise been, but the *same* as that in other regions of the mold.

Nothing in Villanueva et al. or Stagge et al., alone or in combination with Nakashima et al., teaches or suggests a casting die having coolant channels that are spaced 20% more closely in thermally and mechanically stressed areas than they are in horizontally adjacent areas, as required by Applicants claims. Accordingly, Applicants respectfully submit that the rejection should be withdrawn.

*Conclusion*

Applicants respectfully submit that, based on the foregoing amendments and remarks, the claims are now in condition for allowance, which allowance is earnestly solicited. If in the Examiner's opinion a telephone conference would advance the prosecution of the Application, the Examiner is invited to call the undersigned attorney.

**REQUEST FOR EXTENSION OF TIME AND AUTHORIZATION TO DEBIT DEPOSIT ACCOUNT**

Applicants hereby request an extension of time to reply of TWO MONTHS. The Commissioner is hereby authorized to debit Deposit Account 11-0600 for the fee of $400 due according to 37 C.F.R. § 1.17(a)(2). Applicants respectfully submit that no additional fee is due with this paper. If an additional fee is due, the Commissioner is hereby authorized to debit Deposit Account 11-0600 for the required fee.

Respectfully Submitted,

Dated: November 5, 2001

KENYON & KENYON
Richard M. Rosati
Reg. No. 31,792

**CUSTOMER NO. 26646**
PATENT TRADEMARK OFFICE

Exhibit A
MARKED-UP VERSION OF CLAIM AMENDMENTS

1. (Twice Amended) A liquid-cooled casting die for a continuous billet casting comprising:

a form-giving casting die body, made of a material of high heat conductivity, having at least one broad side wall having at least one surface, a part of which defines a meniscus, the casting die body having a pouring side and a cooling-surface side [in thermally and mechanically stressed areas thereof], which cooling surface side is in contact with a bath

wherein the casting die body has a cooling zone [on said cooling-surface side] in thermally and mechanically stressed areas of the die body, the mold surface in said cooling zone having a [greater] rate of heat flow [relative to] 5 – 40% greater than that in the remainder of the surface of the casting die providing increased cooling rate in the critically [stresses] stressed areas the casting die

3. (Twice Amended) The casting die as recited in claim 1, further comprising a die cavity having [of] two broad-side walls situated opposite each other and two narrow-side walls limiting the width of the billet forming a cross-section of the die cavity; said broad-side walls connected to a base and forming meniscus thereon.

5. (Twice Amended) The casting die as recited in claim 3, wherein the die cavity at the first end has at least one hollow space which [can] becomes smaller in the direction of [toward] the second end.

9. (Amended) The casting die as recited in claim 1 [8], wherein the rate of [surface-related] heat flow in the cooling zone [more stressed area of the bath surface] is 10-20% greater than in the other areas of the bath surface.

10. (Twice Amended) The casting die as recited in claim 1, wherein the wall thickness separating the [die] pouring side from the bath is reduced in thermally and mechanically stressed areas of the broad-side walls.

11. (Twice Amended) The casting die as recited in claim 10, wherein the wall [between] separating the pouring side and the cooling surface side of the bath surface area has a thickness that is reduced by 1 to 6 mm compared to the wall thickness in other areas.

12. (Twice Amended) The casting die as recited in claim 1, wherein the casting die body, in a direction running parallel to the direction from [form] the first end to the second end, further comprises at least one groove-shaped coolant channel or cooling bore holes, the spacing between which is at least 20% less in the thermally and mechanically stressed areas [are configured narrower] than it is in horizontally adjacent [other] areas.